

My Story Raksha Kavach

[by Bojji Rajaram the Inventor of the Anti-collision technology](#)

Raksha Kavach- networked ACDs & my grandson

How it began...

Too many lives lost on double line operations of trains either by side collisions because of a derailed wagon or coach obstructing the adjacent track or by sheer head-on collision deeply hurt me , that we as a system are not offering a safer travel to public who are trusting us with their lives. Ordering one more inquiry as a routine , was proving to be too often repeated gimmick, which even the appointing authority started wondering about its efficacy. A ghastly accident moved the Honble Minister so much that he took responsibility and resigned- but engineers / professionals simply shrugged it off. In fact some senior engineers at the very highest levels expressed helplessness in my presence to a staff union leader that technical solution is not available for such cases- and drivers and passengers are at risk at this juncture.

August 99-first concept & Khanna committee

Having heard in August 99 this conversation, I came back with a resolve that we can find a practical solution in this age of instant radio communications and very economic microprocessors . It was on 30 Aug 1999 that I dictated a scheme in one page document that we can provide limited 3 to 4 km range broadcast digital radio trans-receivers with necessary intelligence built into a microprocessor device , when mounted on two approaching locomotives , enable them to mutually identify ,shake hands and if normal move on, or else, initiate automatic brake application to control train speeds to 10 kmph. For self-location GPS (global position satellite systems) are planned to be used. The intention is to merely prevent collision and not to have positive train control system. That makes the system simpler to design. Then I wrote to Khanna commission that we can try this anti-collision device. Shri Vaish one of the members reacted to me , that I being a Corporation, why not do it myself?

A war like target- 90 days to produce prtotype...

I set a 90 day war like target and based on hourly project monitoring , at my level, using all the powers vested , produced the first experimental set up and demonstrated the same to CRB on 15th Oct 99 –foundation day of Konkan Railway within 45 days of concept paper.

The first field prototype we set out to produce by 1st week of December 99 and we successfully demonstrated actually on locomotives how the concept works successfully in the 3rd and 4th weeks of December 99- All the CRSs ,Khanna Committee as well as Minister of Railways and Minister of State for Railways witnessed the demonstrations as to how the ACDs can prevent the collision type of accidents.

Greatest technical challenge...

The toughest challenge was, how to make the GPS which has only 20 to 30m accuracy, to differentiate tracks which are located 5 m from each other. If some one gives the track ID, that is the track on which the loco is travelling, then all the protection is available . But I wanted to make it totally self-sufficient and independent of any human inputs.

Internet and GPS....

Even the GPS was not seen by anyone in my organisation and to get one in normal course has its own problems. Daily I used to work (even now I continue this habit) on internet from 10pm to midnight , searching the sites and finally after checking specifications – and using my son also to research for me – he is in USA- a software expert- short listed a few models.. I ordered for a GPS on the internet itself using my VISA card (at midnight!) and it arrived at my residence in 7 days ! This I used for research.

GPS & my grandson lead to Deviation Count theory...

Connecting it to my laptop first I learned how to use the same. In mobile condition- between office and residence checked the same. Finally idea came when I was carrying the laptop in my hands and watching the display as my grandson aged 5 yrs walked ahead with GPS in his hand, in our lawn:

When he reversed his direction of walking, making me turn and follow him , I found the GPS is extremely sensitive and immediately showed the change in angle- even at the walking speed of my grandson. That actually triggered a thought process that if GPS has this sensitivity to detect change in angle, then why not use this to detect the locomotive taking a turn on the turnout to change its track. Thus I formulated the Deviation Count theory- for locomotives moving in the yard- the change and reversal- of angle of loco motive when it negotiates turnout in a station is now mathematically related to continuously plot the changes in the track identification that the train is occupying. This step has revolutionised the ACD design, by catapulting the system to acquire the magical intelligence of deriving its own track identification, by using the Deviation theory- first time in the world- to the best of my knowledge. (scientists from ISRO and BARC too appreciated that it is really a break-through)

Blessings and guidance from wise men...

This entire formulation of theory I took 15 days to make, and developed the necessary software for the same using first difference equations to have real time computing. At every stage I subjected myself voluntarily to be examined by the Advisory Council formed of renowned scientists and engineers from ISRO, BARC, DoT, NCST, DoE's Software quality testing centres and TIFR. I am grateful for the positive and constructive criticism and encouragement received from them.

Challenges from non-believers...

Those having the knowledge of GPS therefore, initially made too many jokes assuming that I cannot be knowing the weakness of GPS in not being able to differentiate one track from another- over looking my proposed Deviation Count theory. Yes it required daily additional 5 to 6 hours of work over next 6 months personally by me to perfect the practical implementation of theory, to satisfy seemingly impossible, unlikely to be required in practice most of the time, but in the estimate of those in charge of clearing the device, likely to expose and fail my proposal- thus spurring me to take the challenge. But thanks to encouragement at the highest Ministerial levels and support received from the team within Konkan Railway and eminent scientists from BARC and ISRO who encouraged me personally by being with me- we succeeded beyond expectations.

ACD is more than a mere Raksha Kavach—paradigm shift in train operations..

In fact credit should be given to all my railway friends who did not believe in me, thus forcing me to even further improve and write new logic- with the result , from simple anti-collision device , I am now able to offer a moving block system with cab-signalling and further a paradigm shift in train control at stations- by evolving Sat-dham system- eliminating fixed signals and cabling and more economical and logically straightforward, simple but safer & truly train and station route interlocked system- unique in the world. I have filed for patents for the Sat-dham system also in addition for ACD.(all assigned to Konkan railway and the President)

Operations will undergo a truly revolutionary change with the implementation of ACD –Raksha Kavach and Sat–dham system at stations coupled with Moving block system , where with hardly 20% of currently planned capital outlay, planned increased future capacity can be handled with improved safety. This further leads to ultimate development of Intelligent transport systems – the new millenium's dream- which our India can offer to world with our own technology , with justifiable pride. Ultimately this will improve quality of service , while reducing unit cost of service by saving more than 80% in capital outlays, thus making our railways economically viable while simultaneously safety is improved in a radical manner.

A Prayer..

I consider myself only as a fortunate medium for transmitting the solution to our really challenging risk prone railway operations- by way of proposing and proving the ACD. It took less than 6 months of hard and creative work to prove - but more than 18 months to go through our bureaucratic correspondence having no value addition, finally to get our Minister dedicate to Nation the Raksha Kavach.

Perhaps now at least we cannot allow another life handed over in trust to us , to be lost on railway , in another accident routinely classified as human failure! Declare war against accidents- PRAY act now. We must hasten with Raksha Kavach and cannot deny our countrymen and drivers by delaying the same!

Yes , I fondly recollect the small steps taken by my grandson, on a pleasantly sunlit green lawn with GPS in his little hands , leading me , with his big eyes looking back at me with upturned head, for approval whether he is walking correctly- he gave me the break-through solution- and it is for our future generations made up by children represented by my little grand son-that we give our best today. ACD and Raksha Kavach belongs to them!





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[Rear-end-collision avoidance](#)

[Derailment and side- collision](#)



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